BIOLOGICAL ASSESSMENT
MISSOURI NATIONAL RECREATIONAL RIVER

MAY 1992

Prepared by
U.S. Army Corps of Engineers
Omaha District

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Fish and Wildlife Enhancement
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July 6, 1992

Mr. Richard D. Gorton
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Planning Division
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215 North 17th Street
Omaha, Nebraska 68102-4978

Dear Dick:

This is in response to your May 21, 1992, letter requesting review and concurrence on a biological assessment prepared to evaluate routine actions of Section 404 and Section 10 of the Clean Water Act along the Missouri National Recreational River. This response has been prepared in coordination with the U.S. Fish and Wildlife Service's (Service) Nebraska Fish and Wildlife Enhancement Office.

This revision of your March 6, 1991, assessment addressed many of the concerns and recommendations that we brought to your attention in our April 2, 1991, letter to Mr. Kenneth Cooper and subsequent meeting on May 6, 1991. However, some concerns were not addressed, such as the need to include the bald eagle in your assessment (see our March 6, 1991, letter concerning the bald eagle).

We understand the need to proceed with a generic Section 7 clearance for minor Section 404 and Section 10 actions. This clearance is complicated by the need to look at secondary and cumulative impacts for each of the minor actions described in the biological assessment. Secondary and cumulative impacts were not fully addressed by the biological assessment. We believe that impacts to all federally listed species from the minor actions defined in the biological assessment can be avoided if these actions are conditioned as part of the permitting process. The following recommended conditions would allow the Service to provide a concurrence on a not likely to adversely affect call for threatened and endangered species found on the Missouri National Recreational River for the actions defined in your May 21, 1992, biological assessment. These conditions should be included in any permit issued by the Corps of Engineers (Corps).

ACTION	CONDITIONS	SPECIES PROTECTED
Bank Stabilization	1. There shall be no removal of cottonwood trees greater than 16 inches in diameter.	Bald eagle
	2. There shall be no cottonwood tree removal in bald eagle habitat priority designation areas (see 1986 report location of habitat important to federally listed birds species on the Missouri National Recreational River).	Bald eagle
	3. There shall be no disturbance of native prairie vegetation.	American burying beetle Western prairie fringed orchid
	4. There shall be no construction activities within 100 meters of least tern and piping plover colonies until birds have fledged.	Least tern Piping plover
Boat Ramps	1. Same conditions as 1-4 above for bank stabilization.	
	2. For public boat ramps, applicant(s) must post a public information sign at the ramp informing the public about least terns and piping plovers on the river (e.g., signs used by the Nebraska Game and Parks Commission).	Least tern Piping plover
	3. For private boat ramps, applicant(s) must be informed about least terns and piping plovers on the river and the need to keep off nesting areas as well as the potential for prosecution under state and federal laws for taking of these species.	Least tern Piping plover

ACTION	CONDITIONS	SPECIES PROTECTED
Boat Docks	1. Same conditions as 1-4 above for bank stabilization.	
	2. Applicant(s) must be informed about least tern and piping plovers on the river and the need to keep off nesting areas as well as the potential for prosecution under state and federal laws for taking of these species.	Least tern Piping plover
Irrigation and Domestic Intakes	1. Same conditions as 1-4 above for bank stabilization.	
	2. Intakes shall be fitted with screens no greater than 0.25 inches in diameter.	Pallid sturgeon
	3. Intake velocity shall be set at no greater than 0.5 feet per second.	Pallid sturgeon
	4. Intakes shall be placed at 20-foot depths. If a 20-foot depth cannot be achieved, then intake velocities shall be reduced to 0.25 feet per second.	Pallid sturgeon

The above conditions and concurrence will be subject to a review and re-evaluation after two years. This review, to be provided to the Service by the Corps should specifically examine if the cumulative and secondary impacts to federally listed species were avoided as intended. For the purpose of that review, the Corps should maintain a log of the location, size, and type of activity subjected to the conditions cited above.

In accordance with Section 7a(1) of the Endangered Species Act and to aid in the above noted review, we also recommend that the Corps use their engineering and sediment transport expertise to evaluate the cumulative effects of bank stabilization on sediment transport and thalweg "training," specifically for the Missouri National Recreational River. Because of the high degree of stabilization now in place (25 miles of the 59-mile reach and 21 percent of total bank length are now stabilized), the Corps should determine if stabilization can continue indefinitely with no potentially adverse effects on alluvial processes, specifically, potentially reduced thalweg migration and subsequent channel incision and sandbar stabilization. This is necessary to ensure cumulative actions do not adversely affect channel processes that may create and maintain sandbar habitats used by endangered species. The results of this study or evaluation should be included in the two-year evaluation.

Additionally, as the new management plans (including Fort Randall and Gavins Point reaches) are completed for the Missouri National Recreational River, this project action should be re-evaluated. Section 7 consultation may need to be re-initiated if new information becomes available, if new species are listed, if project actions are modified from that described in the biological assessment, or if project actions cause an effect to a listed species in a manner or extent not considered during this informal consultation.

This letter does not preclude the opportunity for the Service to provide comments on Section 404 or Section 10 actions in accordance with the Fish and Wildlife Coordination Act.

If you have any questions or need further information, please contact Nell McPhillips of my staff or me at (605) 224-8693.

Sincerely,

Douglas A Scarle

M.S. Zschomler
State Supervisor
Fish and Wildlife Enhancement

cc: SS/FWE; Grand Island, NE
FS/FWE; Bismarck, ND

BIOLOGICAL ASSESSMENT
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MAY 1992

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INTRODUCTION

BACKGROUND

A 59-mile stretch of the Missouri River between Gavins Point Dam and Ponca State Park was added to the National Wild and Scenic Rivers System by a 1978 amendment (Section 707 of the National Parks and Recreation Act) to the Wild and Scenic Rivers Act of 1968. This 59-mile reach is known as the Missouri National Recreational River (MNRR). Primary responsibility for implementing the project was assigned to the Secretary of the Interior, while secondary responsibility was given to the Secretary of the Army acting through the Chief of Engineers. In 1980, the Secretary of the Interior and the Chief of Engineers signed a Cooperative Agreement which gave overall administrative authority to the Department of the Interior, while day-to-day management of the river was assigned to the Corps of Engineers.

Shoreline alteration activities along the MNRR are in part subject to Section 404 of the Clean Water Act, which regulates fill below the ordinary high-water mark, and Section 10 of the River and Harbor Act of 1899, which regulates any activity affecting navigable waters of the United States. Activities on the high banks are not subject to Federal jurisdiction, but rather to any local land use ordinances as they exist in the respective jurisdictions. Water diversions or appropriations from the river for irrigation and other uses are subject to State law. Since passage of the recreational river designation, additional woodland

and accretion land have been placed in cropland, some of which is under irrigation. Some of these lands are subject to periodic flooding, but do not necessarily come under Section 404 review unless they involve placement of fill in wetlands or channels.

In order to make the regulatory program more responsive to shoreline management objectives of the MNRR, a general permit was developed by the Omaha District for a 5-year period, 1983 to 1988, in order to target bank stabilization work proposed by individuals and local public entities. The permit did not directly apply to actions such as water intakes, pipelines, boat ramps, fences, marinas or actions landward from the high bank, such as residential development or woodland clearing. This permit provided for four alternative designs involving the use of graded rock riprap or bulkheads. An exception was that clean concrete was acceptable if it was graded and free of protruding steel or other materials. However, the permit received limited use by the public because of technical or economic reasons. As a result, regulation has continued to follow the individual permit process. The latter has been rather cumbersome because the concerned Federal agencies have different perceptions and goals on how the river should be administered (Hargrave, 1990).

FEDERAL ACTION

Several activities along the 59-mile reach of the MNRR require the issuance of a Section 10/404 permit. Most of these activities can be divided into four types: stabilization of eroding banks, construction of river access points, construction of boat docks/piers, and placement of irrigation and domestic water intakes. Although these activities can be further divided into major and minor actions, this assessment only deals with minor actions. The minor actions that relate to the above-mentioned activities are defined as follows.

- Bank stabilization of less than or equal to 500 feet. The stabilization material would consist of either field stone or 2-foot-square concrete slabs. Associated with the stabilization would be any minor bank shaping in order to properly prepare the bank for stabilization.

- Boat ramps. This would include private (individual) boat ramps as well as small public access points. In the case of the later, these public access points would have nothing more than a ramp, vault toilet, and small parking area.

- Boat docks and fishing piers. These structures would be used primarily to dock boats or as a place for shoreline fishing.

- Irrigation and domestic intakes. In addition to the placement of intake structures, any bank stabilization or bank preparation that is required for the placement of the pump also would be included.

PURPOSE OF ASSESSMENT

Under Section 7 requirements outlined in the Endangered Species Act and subsequent amendments, Federal agencies are required to determine the effects of their actions on any species that are listed or proposed for listing. The assessment will not cover two other federally listed species--the bald eagle, listed in 1978, and the peregrine falcon, listed in 1973. A biological assessment completed in 1985 by the Omaha District concluded that the MNRR would not likely affect these species. The U.S. Fish and Wildlife Service (USFWS), acting as an administrator of the Endangered Species Act, concurred in that determination.

The Missouri River Division, Corps of Engineers, has been preparing information related to potential effects of the entire Missouri River main stem operations on federally listed species since 1986. This

information has since been made available to the USFWS who has issued a biological opinion on main stem hydrologic and related effects on bald eagles, least terns, and piping plovers.

The interior least tern, *Sterna antillarum athalassos*, was listed as endangered on 28 May 1985, while the northern great plains population of the piping plover, *Charadrius melodus circumcinctus*, was listed as threatened in January 1986. A discussion of these species has been included in this document. The pallid sturgeon (*Scaphirhynchus albus*) was listed as an endangered species on 6 September 1990 and is also discussed in this assessment. However, any findings should be considered as tentative. Through these Section 7 studies and ongoing life history and habitat studies, additional information will be obtained to assist in understanding the pallid sturgeon's habitat needs, segments of the river where potential habitat exists, and insights into how populations can be restored. The Eskimo curlew (*Numenius boreales*) was listed in 1967 and the American burying beetle (*Nicrophorus americanus*) and western prairie fringed orchid (*Platanthera praeclara*) were listed in 1989. These species are also included in this assessment.

The purpose of this biological assessment is to determine the effects of the minor activities listed above on the endangered or threatened species that may be found along the MNRR. The development of the biological assessment will avoid the necessity to develop individual biological assessments for each permit action that falls within the parameters listed.

STUDY AREA CHARACTERISTICS

GENERAL

The Missouri River within this 59-mile reach is located in the middle portion of the 2,300-mile-long Missouri River and flows through the upper dissected till plains of the Central Lowland Province. Original vegetation was primarily tall-grass prairie, with ribbons of the eastern deciduous forest extending into the till plains along the major river valleys.

The upstream end of the project is the downstream terminus of the Gavins Point project, River Mile (RM) 809.9, while the downstream end is the downstream terminus of Ponca State Park, RM 751.9. The river channel forms the approximate boundary between the States of Nebraska and South Dakota. The corridor of the river segment includes the river channel, selected slopes visible from the river, and lands above the riverbank required to preserve the river characteristics. An early river management plan (U.S. Army Corps of Engineers (USACE), 1980a) identified the corridor as containing about 19,600 acres. With the exception of lands under the mean high-water mark of the river, most of the corridor is in private ownership (figure 1).

A moist, subhumid climate prevails in the study reach. It experiences temperatures noted for wide fluctuations and extremes. Skies are usually sunny. Summers tend to be hot and humid while winters are cold and dry. The mean July temperature is 76 °F, while that in January is 20 °F. Growing season length is slightly more than 150 days, while average annual precipitation is 23.5 inches at Yankton, near the upstream end of the project. The amount of ice in the river during the

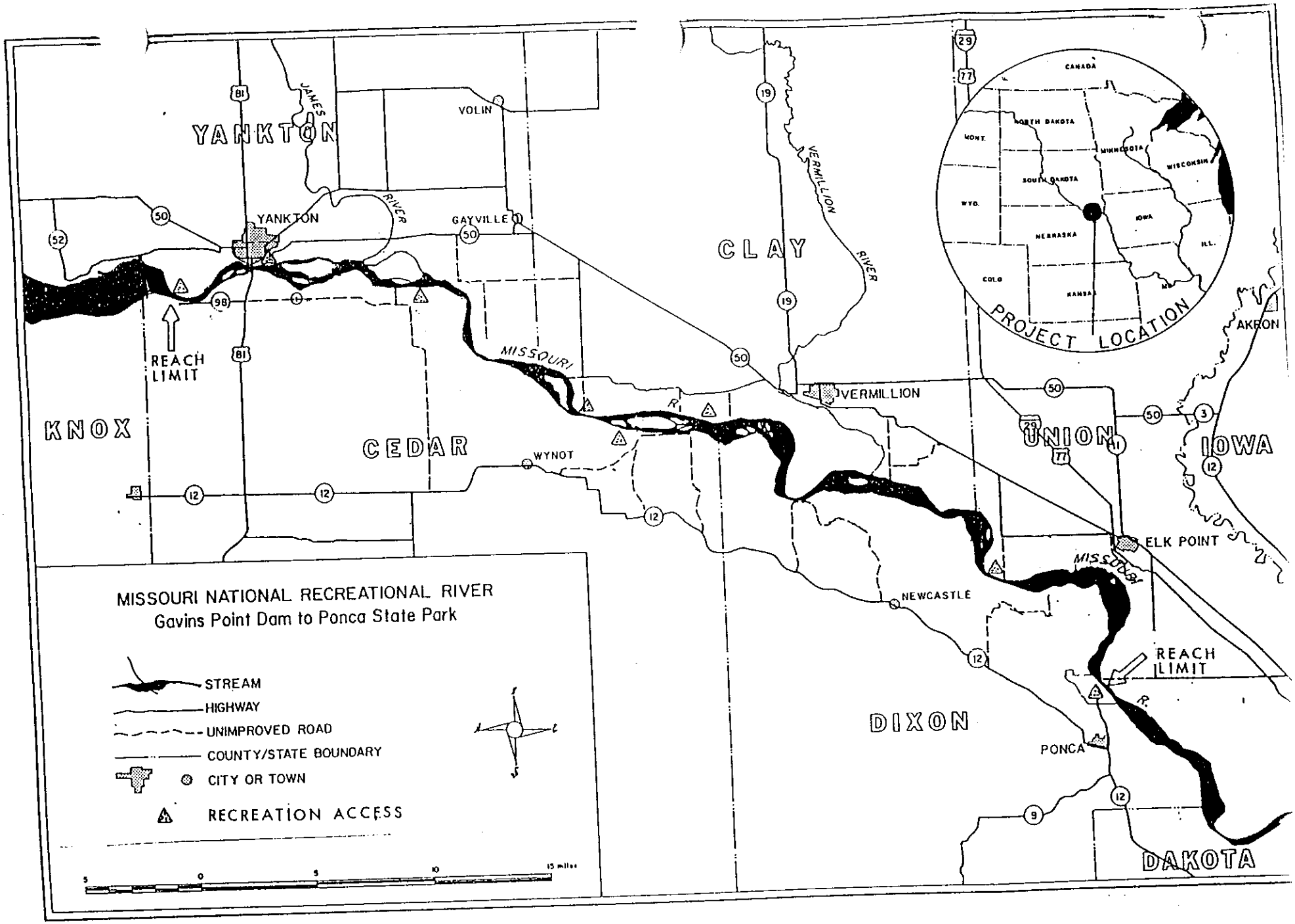

MISSOURI NATIONAL RECREATIONAL RIVER
Gavins Point Dam to Ponca State Park
STREAM
HIGHWAY
UNIMPROVED ROAD
COUNTY/STATE BOUNDARY
CITY OR TOWN
RECREATION ACCESS
YANKTON
VOLIN
GAYVILLE
CLAY
VERMILLION
UNION
IOWA
AKRON
ELK POINT
NEWCASTLE
DIXON
PONCA
DAKOTA
KNOX
CEDAR
WYNOT
REACH LIMIT
REACH LIMIT
MISSOURI R.
JAMES RIVER
VERMILLION RIVER
PROJECT LOCATION
CANADA
NORTH DAKOTA
MONT.
MINNESOTA
WISCONSIN
SOUTH DAKOTA
WYO.
NEBRASKA
IOWA
ILL.
COLO.
KANSAS

Figure 1

winter varies, depending upon flow releases from the dam and the length of time that arctic air masses stagnate over the area. The river immediately downstream from Gavins Point Dam is usually open, although downstream reaches may become partly or entirely frozen over between December and March. During mild winters, the river does not completely freeze over.

RIVER GEOMORPHOLOGY

On the Nebraska side, the river meanders frequently against heavily wooded bluffs, whereas in South Dakota a broad, nearly flat flood plain stretches north for many miles. During past floods, the channel frequently shifted its course while creating new channels, isolating old channels, and destroying and building islands. Present flood plain relief and surface features, especially the numerous meander scars and the few oxbows, reflect these alluvial events. At some sandy overbank depositions, wind action has created sand dunes.

The present flood plain surface was last reshaped by the large and widespread flood of 1952. Since 1955, through the operation of Gavins Point Dam, inflows have been confined within the channel and changes largely reflect bank and island erosion as a result of lower flows. Because of extensive bed degradation during the past 25 years, the channel has been lowered several feet so that in many reaches, it is now entrenched from 10 to 15 feet below the adjacent flood plain. Because of lateral bank erosion in geologically "soft" deposits, the channel has also widened in many areas and is now over 1 mile wide in places. However, there are several reaches where considerable natural control exists. Resistant clay or cobble deposits in these areas have made the channel cross section relatively stable.

Channel bottom deposits are typically sand, but some reaches are partly armored with gravel or cobble. Within some natural control

areas, such as at sharp bends, a solid clay bottom may exist. There are several long, fairly straight or moderately sinuous reaches where bed conditions are in a state of flux in response to seasonal changes in flows. Constantly changing dunes and troughs are typical bed forms in these reaches. These features develop and move downstream during the summer high-flow period, but during low-discharge periods in winter, the dunes and troughs are believed to be more stable. Although little dune movement may occur, the tops of the dunes do become truncated, and these dunal areas become a sediment supply source for downstream areas. In sharp bendway areas, as next to a bluff, the channel may be very deep and quite narrow. The channel is still in its natural, partly meandered and braided form. Under these conditions, a wide range of flow velocities occur (near zero to 8 feet per second).

The river islands vary in size, elevation, sediment composition, age, and nature of vegetation. They can be broadly grouped as old islands (formed before river regulation) or new islands (formed after regulation). The former were built by large floods, are mantled with coarser sediments, are covered with early- to mid-successional woody vegetation and are no longer subject to flooding and sediment deposition. The latter have existed for less than 40 years, were built by regulated flows, are lower in elevation, and are composed of fine sands and silts. As such, these islands are susceptible to flooding and waterlogging and are either largely barren or covered by early seral stages of woody, herbaceous, or wetland vegetation.

HYDROLOGY

The flow characteristics of this river segment have changed drastically since development of the main stem for flood control, navigation, and hydropower in the 1950's through the early 1960's. The changes in flow rates during the preregulation period led to wide fluctuations in river stages. High flows were generally coincident with

the spring snowmelt period from the plains or the early summer storm on the plains, when combined with melting of snowpack in the mountains. The higher, unregulated stages flooded and scoured the islands and overbank areas; receding and low stages exposed areas along the banks and sides or midchannel sandbars.

Under regulated conditions, discharges are quite uniform during the navigation season (April through November) and during the non-navigable or winter season (December through March). Targeted releases from Gavins Point Dam are about 31,000 cubic feet per second (c.f.s.) during the navigation season and about 15,000 c.f.s. at other times.

Near-record drought conditions prevailed over the upper Missouri basin during 1987-91, and a sizable portion of storage in upstream reservoirs was used. In 1990, as the effects of the drought worsened, flow releases during much of the summer were cut to between 25,000 to 27,000 c.f.s.

EROSION AND BANK STABILIZATION

Construction of several extensive streambank protection projects was authorized and completed under Section 32 of the Water Resources Development Act of 1974 and Section 161 of the Water Resources Development Act of 1976 (hereafter referred to as Section 32 projects). Construction of these projects was concentrated at several locations where bank loss was taking place at a rate of several acres annually. This work was intended to protect about 25 miles of bank length, or 21 percent of the total bank length within the MNRR. The work was performed in such a way as to avoid impacts to chutes, backwaters, and other important aquatic habitats. The locations of the Section 32 projects are listed in table 1.

Table 1
Section 32 Bank Stabilization Projects

Project/General Location	Bank	River Mile
Cedar County Park	Right	798-800
Goat Island	Left	795-798
Vermillion Boat Club	Left	782-787
Brooky Bottom Road	Right	783-787
Mulberry Bend	Right	775-776
Vermillion River Chute	Left	769-772
Ryan Bend	Right	767-769
Ionia Bend	Right	759-763
Elk Point I & II	Left	753-757

Since completion, these structures have required occasional rehabilitation and reinforcement to maintain the original project purpose. Several tiebacks or extensions have been required to prevent flanking or excessive scalping. Other work conducted by Federal and local interests has been concentrated between Yankton and Gavins Point Dam. This has provided protection for the U.S. Highway 81 bridge, the Yankton water plant, Sacred Heart hospital, and Riverside Park. Since the MNRR was designated in 1978, approximately 45 small projects have been authorized for local interests. These projects provide about 7 miles of stabilization. This brings the cumulative total to about 32 miles or nearly 27 percent of the total bank mileage.

The Section 32 demonstration program, utilizing a variety of bank armoring and flow-deflection devices (mostly revetments and short spur dikes), has been very effective in controlling erosion at the designated sites. Structures were placed where they would not block or deflect flows from river chutes. In addition, at several locations, mature trees, shrubs, and grasses have become established over the riprap, restoring somewhat of a natural appearance to the banks. Omaha District studies along the Platte River in regard to hydraulic effects of various structures have indicated that revetments and short spur dikes have only a minor hydraulic effect. Although there is localized toe scour along

the bank, the structures do not contribute to island degradation in the channel (USACE, 1990b).

Overall, the streambank erosion rate has been reduced from about 3.5 acres/river mile/year (USACE, 1978) to about 1.0 acre/river mile/year or a reduction of about 70 percent (River Pro's, 1986). The existing annual average loss rate is about 41 acres/year for the left bank and about 73 acres/year for the right bank. Erosion losses on the older James River and Goat Islands have been high since closure of the dam. For the 1978-1985 period alone, total losses on these islands have been 24.3 and 51.1 acres, respectively. Specific hydraulic/geological parameters relating to these losses have not been evaluated.

From 1979-85, sandbar island erosion of 273 acres was noted in the MNRR reach. Although this was partly balanced by formation of lower, new bars, a 16-percent net loss of surface areas was reported (USACE, 1989a).

LAND USE

Land uses in the river corridor include agricultural, seasonal and permanent residences, commercial, transportational, recreational, and fish and wildlife habitat (USACE, 1980a; USACE, 1985).

Agricultural uses of the corridor dominate. Past erosional losses of cultivated high-bank land have resulted in additional clearing of high-bank woodlands or reclamation of lower bank accretion lands. Both irrigated and nonirrigated crops of corn or soybeans are grown. Hay production and grazing lands also exist along the river, especially in wet areas or in bottomland woodlands. Most of the residential and commercial development is concentrated from the Yankton area upstream to Gavins Point Dam. Downstream from Yankton, scattered residences and clusters of residences are found along county roads that provide access

to the river. Developed areas are found at the Vermillion Boat Club area, the Cedar County Park area, the Brooky Bottom area, and the Ponderosa area near the mouth of the Vermillion River.

Public parks and river access areas found on the Nebraska side downstream from the Gavins Point project includes two locations in Cedar County (RM 799 and 785) and one location at Ponca State Park (RM 754) at the extreme downstream end of the MNRR reach. Areas in South Dakota include Riverside Park at Yankton (RM 805-806), Myron Grove (RM 787), Clay County Park (RM 780.5), and Boulton Bend (RM 763). Existing recreation for the area at the time of designation was 950,000 recreation days (USACE, 1980a). Major activities are fishing, swimming, boating, camping, picnicking, and hunting. This use was projected to increase by 750,000 days by 1990 (USACE, 1978).

Since 1979, improvements to public access areas have been limited to the Yankton area and to a State of South Dakota boat ramp in the Myron Grove area. Significant improvements have been made at Riverside Park at Yankton, which included a new boat ramp with increased capacity. It is estimated this will double annual visitation rates in the upstream portion of the MNRR in the near term (USACE, 1988b). In Nebraska, Dixon County is also interested in developing a small river access area. There are also several private boat ramps along the river at rural residences.

Wildlife management areas are all located in bottomland areas in South Dakota. These include the Warren, Clay County, Bolton, Frost, and Myron Grove State game management areas. These areas are managed primarily for white-tail deer. Other lands provide wildlife habitat but are not designated for that purpose. An unknown amount of these lands adjacent to the river have been lost to erosion. The riverbanks along these areas are currently unprotected.

FISH AND WILDLIFE HABITAT

Most of the terrestrial habitat areas are found adjacent to the channel or along the steep bluffs and drainages entering the river on the Nebraska side. Principal habitats include elm-oak, sandbar, sand dune, cottonwood-willow, cottonwood-dogwood, and agricultural lands (Clapp, 1977).

The elm-oak community is a community of the higher bluffs, while the others are found in the bottomlands. The sandbar, sand dune, and cottonwood-willow are all early- to mid-seral types, with the cottonwood-dogwood community representing a later seral stage.

Extensive losses of bottomland woodlands as a result of the conversion to agricultural purposes was noted between 1956-1975 in a land use and habitat study (Siouxland Interstate Metropolitan Planning Council (SIMPCO, 1978). Since then, however, the rate of loss has declined. In some high-bank areas, mortality of cottonwoods and the deterioration of bottomland stands has been noted. However, because of the widening and degradation of the river and lower river stages, new cottonwood stands appear to be regenerating at rates exceeding mortality. These new stands are located on most of the larger islands and within accretion areas found along the river bends.

The sand dune areas, relics of the 1952 and earlier floods (Clapp, 1977), are best observed along the South Dakota side, especially near the Warren area, which is close to Elk Point. Comparisons of existing conditions with older photographs indicate that the sand dunes are becoming invaded with woody vegetation and are assuming the characteristics of a woodland savanna.

Vegetated islands, with a variety of seral stages representing both upland and wetland communities, provide the most habitat diversity in

the corridor. They are the least disturbed and have the most habitat value for terrestrial and semi-aquatic wildlife.

Open sandbars were identified as important habitat for shorebirds and as loafing areas for wintering waterfowl (Clapp, 1977). The amount of this habitat type in the river channel has greatly declined since operation of the main stem system. The SIMPCO study cited losses of over 4,000 acres between 1956 and 1975. Schmulback et al., 1981, reported only 2,200 acres of sandbar habitat remaining as of 1977. By 1985, sandbar acreage had further shrunk to 1,500 acres (USACE, 1989b) and, in 1990, observations indicated that this habitat type had deteriorated even further. Currently, the losses of the existing sandbar resource base is estimated at 2 percent per year (USACE, 1989d).

Aquatic habitats along the MNRR include main channel, main channel border, chutes (side channels), pools, confluences of tributary streams, submerged sandbars, and backwater/marsh areas. The backwater/marsh areas are very important because approximately 50 percent of the fish species found in this reach depend upon this type of habitat at some stage in their life history.

Volesky (1969) described the cattail marshes as being abundant along the river, comprising about 5 percent of the channel area. The marshes were typically found in backwater areas and often contained admixtures of young willows and cottonwoods. No significant areas of aquatic bed wetlands were apparently associated with these marshes/backwaters (Volesky, 1969; Nord, 1971). The loss of marshes and chute habitat has been identified as an area of concern. The processes involved include siltation (Clapp, 1977) and bed degradation (Kallemeyn and Novotny, 1977). Siltation fills up the marshes, changing them to mesic environments, while bed degradation reduces the frequency of flooding and reduces ground water levels. Although there have been reports of additional and continuing losses of these habitats in the

1980's (Schmulbach, 1990), a net loss cannot be confirmed or quantified as yet because some additional chutes and backwaters have been created in the river during the same time period.

FISH AND WILDLIFE

The wildlife resources along the MNRR are very valuable and provide an opportunity for hunting, fishing, and nature observation. Mammals found in various terrestrial habitats along the river include 48 species. Only one species of big game (white-tail deer) occurs but many furbearers are found, including beaver, muskrat, mink, red fox, coyote, badger, raccoon, and weasel. Smaller mammals include mice, voles, moles, ground squirrels, and cottontails. Birds living in the area year-round include 25 species, while another 58 species commonly nest there. Fifteen species are winter residents. Over 100 species are transients or utilize the area during spring or fall migration. Several species of waterfowl are an important component of the avian fauna.

With the exception of tern and plover studies, bald eagle surveys, waterfowl surveys, and beaver studies, few scientific details on wildlife populations and their habitat use are known.

Federally listed wildlife species which may be found in the study area include the bald eagle, interior least tern, piping plover, Eskimo curlew, pallid sturgeon, American burying beetle, and western prairie fringed orchid. (The river reach is considered to provide essential habitat for the least tern (USFWS, 1990b).) The American peregrine falcon is a rare migratory transient. Rare species that are listed by the States of Nebraska or South Dakota which could occur in the area on a temporary or permanent basis include the osprey, false map turtle, the western spiny softshell turtle, the eastern big nose snake, northern water snake, and the river otter.

Although the pattern of flow and sediment loading have been drastically altered by main stem operations, most of the native fish species are still present (Schmulbach, et al., 1975; Kallemeyn and Novotny, 1977). The changed conditions, however, have reduced the dominance of fish species typical of large, turbid rivers, especially populations of paddlefish, river carpsuckers, buffalo fishes, and some native minnows, shiners, and chubs. Fishes found in various levels of abundance in the MNRR include shovelnose sturgeon, carp, channel catfish, sauger, walleye, white bass, goldeye, freshwater drum, river carpsucker, paddlefish, shortnose gar, smallmouth buffalo, largemouth buffalo, shorthead redhorse, blue sucker, gizzard shad, and several species of shiners and minnows. (Schmulbach, et al., 1975). Lack of spawning habitat and excessive fishing pressure is typically cited as the reason for decline of paddlefish and several other river fishes (Hesse and Mestl, 1990). The 59-mile reach, however, affords a good sport fishery, with most angling concentrated in the reach between Yankton and Gavins Point Dam. Species important to least terns, such as shiners and minnows, are also abundant. A grass carp, an exotic fish species, was caught in the river by Schuckman (1982), and, in 1988-89, both bighead and grass carp were caught (Hesse & Mestl, 1990). Given existing mortality factors, it is uncertain if grass carp numbers will be able to grow to sufficient numbers to threaten aquatic vegetation or other fish along the river.

Shallow marsh, backwater, and chute habitats are utilized by macroinvertebrates, amphibians, aquatic birds, and fish. About one-half of the river fish species utilize them for spawning and nursery areas (Kallemeyn and Novotny, 1977). The presence of snags in the main channel, abundant at some locations, provides considerable habitat structure for main channel-dwelling fish and also allows the growth of periphyton. Deep pool habitat also occurs in the main channel, along with numerous riffle areas. The presence of a stabilized bank in protected reaches also improves the habitat structure and food

production for channel margin areas. There is some concern that the depth of pools behind islands has decreased in the past decade, possibly in association with island erosion and degradation (Schmulbach, 1990). However, these pools change seasonally and from year-to-year in response to flow conditions, so a conclusion cannot be made at this time.

Large populations of waterfowl winter in the reach when open-water areas are present. Common species include the mallard and blue-winged teal. The most common wading bird along the river is the great blue heron, which was noted in large numbers in the summer of 1990.

The pallid sturgeon is listed as a federally endangered species, although the sturgeon chub and sicklefin chub, now Category 2 species, could be listed in the future. The paddlefish and blue sucker are also under Federal review but are both locally common in the Missouri River (Harberg, 1990). Of the above fishes, only the chubs and the pallid sturgeon are on the State endangered species lists.

THREATENED AND ENDANGERED SPECIES

The purpose of this section is to highlight aspects of the natural history of endangered and threatened species as they relate to the management of the MNRR.

LEAST TERNS AND PIPING PLOVERS

POPULATION LEVELS

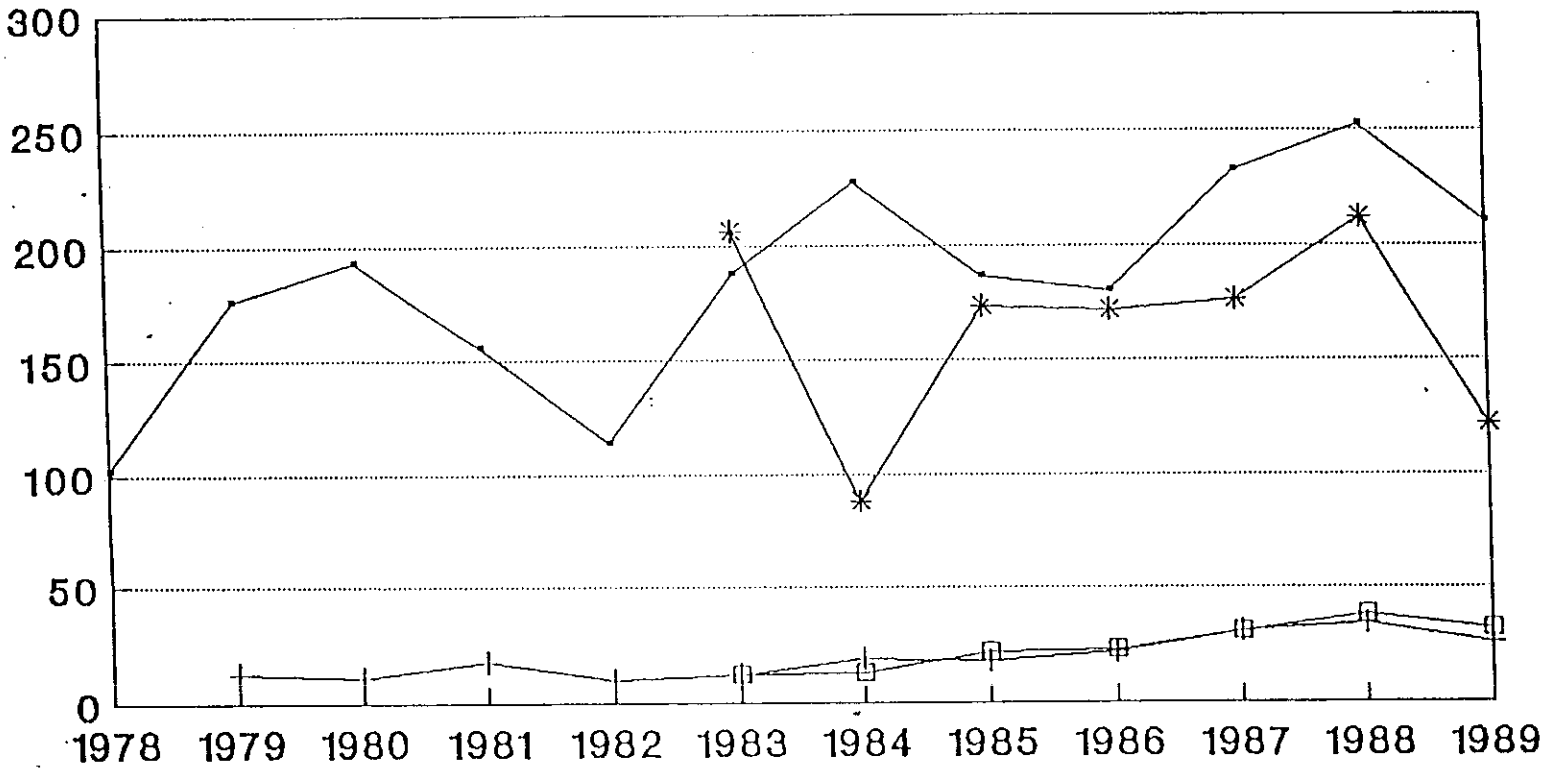
The entire lower and middle reaches of the Missouri River originally were inhabited by least terns and piping plovers. This pattern, however, changed as the river was developed. The influence of channelization on least terns in the Sioux City area was noted by Youngsworth (1930). The influence of recreation facility development just downstream from Gavins Point Dam between 1959-1970 on displacement of a tern colony was observed by Hall (Ducey, 1985). Ducey also suggested that the MNRR has been a refuge for terns.

Extensive surveys of interior least terns in 1986, 1987, and 1988 indicated a population of 4,000, 4,800 and 3,959, individuals respectively, in three major interior drainages--the Missouri, Rio Grande, and Mississippi basins. Least tern populations along the Missouri River comprise about 12 percent of the total interior population (USFWS, 1990a).

Surveys within the MNRR reach of the Missouri River have been conducted by various concerned agencies since 1978 for least terns and since 1983 for piping plovers. The number of adults and colonies of both species has been fairly stable during this time (figure 2). Surveys show that least tern populations in the MNRR account for about 40 percent of those found along the Missouri River. Estimates on the number of piping plovers on the Northern Great Plains are at 2,500 birds. About 22 percent of the Northern Great Plains population is found along the Missouri River, and 34 percent of that population is in the MNRR reach (USFWS, 1990a). Piping plovers also extensively utilize many barren shorelines along inland lakes and wetlands in the Great Plains. Reasons for the year-to-year fluctuations are not well understood. Habitat availability in other segments of the Missouri River or in other Great Plains areas, river stage at the time of nest

LEAST TERN-PIPING PLOVER POPULATIONS

Missouri National Recreational River



Gavins Point Dam to Ponca, Ne

Figure 2

initiation, and mortality incurred on the wintering grounds and during migration are also expected to affect the number of returning nesting birds. Recovery plans prepared for the least tern (USFWS, 1990b) and the piping plover (USFWS, 1988a) have targeted desired population levels in the MNRR and the Fort Randall reach of the river. A level of 400 adults is desired for terns and 500 adults for plovers.

BREEDING CHRONOLOGY

Although the nesting chronology of the least tern is somewhat later than the piping plover, least terns and piping plovers usually arrive at the MNRR from early- to mid-May and begin nesting and incubation in late May and early June. Historically, because of high-water conditions in some years, nesting was not reported until June or July, after recession of the river from mountain snow melt or plains rainstorms. (Youngworth, 1930; Hardy, 1957). At the present time, if initial nests are destroyed, renesting efforts may continue throughout much of July (Dirks and Higgins, 1989). For least terns, nesting usually takes place in June, lasting from 18 to 21 days. The fledgling phase typically occurs between late June and late July, lasting another 18 to 21 days. The post fledgling phase typically lasts 20 days, during the middle to late July and early August periods. In contrast, piping plovers have a 4-week incubation period, a 5-week brooding period, and may nest a few days earlier than terns (Nebraska Game and Parks Commission, 1985). Terns and plovers generally leave the area in late August to early September.

NESTING HABITAT SELECTION

Large rivers or lakes that have wide expanses of barren to sparsely vegetated sandbars and beaches and wide buffers of open water, are preferred nesting habitat for interior least terns and piping plovers (Hardy, 1957; Ducey, 1981; Faanes, 1983; Nebraska Game and Parks Commission, 1985; Armbruster, 1986). Other nesting parameters important to the birds include height of the sandbar or beach, percent of

vegetation cover, height of vegetation cover, type of substrate, and availability of food. Previous nesting success is also likely to be important. Nest siting is generally timed to follow the recession of spring or early summer high flows or lake levels (Ganier, 1930; Stiles, 1939; Hardy, 1957; Schulenberg et al., 1980). Preferred nesting sites are relatively barren sandbars, with vegetative cover of less than 20 percent, and vegetation heights generally less than 40 centimeters (cm) (Schwalbach, 1988). Selection for elevation above the river water level is also an important variable for nest siting. Before river regulation, birds on the Missouri River usually selected the higher sandbars far from the water's edge, but given the vegetation encroachment problem on the MNRR, birds are now forced to locate on the lower-elevation bars closer to the water. Plover and tern site selection studies during 1986-87 in the MNRR indicated little variation in both horizontal distance from heavy vegetation cover and vertical distance above the water surface (Schwalbach, 1988). In 1986, the average distance of least tern nests from vegetation was 65 feet, whereas nests were placed only 0.63 feet above the water-surface elevation. In 1987, nests were separated by a mean space of 88 feet from vegetation and by a 1.5-foot water-surface elevation buffer.

Because of the sometimes transitory nature of nesting habitat, McNicholl (1975) described least terns as having weak site tenacity but strong group adherence. However, least terns have also been noted to display high site fidelity by continuing to use an area year after year as long as the site remains suitable (Burger, 1984). This includes marginal sites where successful nesting has occurred (Massey and Atwood, 1979). Recent studies on the Platte River (Lingle, 1988) indicated that only 23 percent of the terns and only 40 percent of the piping plovers, returned to their natal colony. However, most returned to the same general area of the river.

Dry conditions are more important for nesting than texture. Although terns prefer to nest on the fine to coarse sand characteristic of MNRR sandbars, they also nest on gravels, salt-encrusted mud flats (Grover, 1979; Schulenberg et al., 1980), and gravel-surfaced parking lots (Schwalbach et al., 1986). The coastal race of the least tern has been reported nesting on gravel or roof tops of public buildings (Fisk, 1978; Hayes, 1980). Along the Platte River, birds are using sand and gravel spoil areas more than the river sandbars (Dinan and Carlson, 1982; Dinan, 1983; Faanes, 1983; Lingle, 1988). Piping plovers are also not highly selective in terms of substrate. They nest on coarse gravels, fine sands, or salt-encrusted mud flats (Dinan and Carlson, 1982; Dinan, 1983; Prindiville, 1986; Lingle, 1988).

Experimental manipulation of vegetation to benefit sandbar nesting habitat for least terns and piping plovers was first initiated in late 1987 (USACE, 1989c). Methods used include tillage in 1987, followed by applications of herbicide in 1988-89. In 1988-89, limited mowing of vegetation was conducted. Aerial applications of Rodeo in 1988, followed by pre-emergent applications of Norsac 10g in the spring of 1989, was effective in reducing vegetation growth on parts of two sandbar islands, totalling about 30 acres. In 1989, least terns attempted to nest on one of the islands, but nests were destroyed by predators. Piping plovers succeeded in fledging one bird. In 1990 and 1991, the same sandbar areas were cleared which remained relatively bare during the entire nesting season. Again, reproductive success was limited because of predation.

Proximity of food to the nesting site is more important for least terns than plovers. Plovers not only feed on a wide variety of small, benthic invertebrates along the shoreline, but also on terrestrial insects such as grasshoppers and beetles (Prindiville, 1986; Lingle, 1988). Least terns, however, prefer fish and feed in any body of water that supplies fish such as minnows, shiners, killifish and other small

fish (Hardy, 1957; Schulenberg et al., 1980; Dinan, 1985). The fishing location is generally not over 1 to 2 miles (Youngworth, 1930; Schulenberg et al., 1980; Lingle, 1988) from the nesting colony, although preferred distance is likely considerably less (Faanes, 1983; Armbruster, 1986). Location of the feeding site may also be affected by turbidity. Near Sioux City, Stiles (1939) observed that the terns fed on oxbow lakes when the Missouri River was in a high-flow condition and turbid. Along the Mississippi River, Ganier (1930) observed much feeding in the quieter waters of oxbows and borrow pits behind levees. Along the Platte River, least terns also forage in sandpit lakes (Dinan and Carlson, 1982). Some foraging of terns on insects (Schulenberg et al., 1980) has been reported.

BREEDING AND REARING SUCCESS

Many factors can affect the breeding success of both least terns and piping plovers. Part of this is due to their habit of nesting in exposed areas along water bodies that are susceptible to flooding, erosion, temperature extremes, aerial and ground predators, trampling, hailstorms, windstorms, and other natural hazards (Ganier, 1930; Stiles, 1939; Tout, 1947; Hardy, 1957; Schulenberg et al., 1980; Ducey, 1981; Dryer and Dryer, 1985). These factors may act singly or additively on breeding success. For example, Burger and Lesser (1979) found increased predation in common tern (*Sterna hirundo*) colonies that had been partially destroyed in flooding and suggested that sufficient numbers of protective adults must be maintained for successful mobbing of predators. The few remaining terns in a partially destroyed colony did not attempt to chase the Franklin gulls that landed near nests, although they would have earlier.

Low breeding success in many shorebird species, especially a high loss rate of eggs and chicks, may be balanced somewhat by the apparent longevity of the birds. Marples (1934) assumed that, on an average, least terns in England lived an average of 5 years. Banding and

recovery records of least terns, as of 1980, showed that nearly 17 percent (13 of 78) of the recoveries exceeded 10 years and 6.4 percent exceeded 15 years. Two birds, banded as chicks, were found 21 years later (Thompson, 1982). Adult survivorship values of the interior least tern have not been developed, and the proportion of older, experienced individuals in the nesting population is not known. In banding studies on the Platte River, however, return rates of banded birds have been low, and older birds were few. Least terns had a return rate of 30 percent, while that for piping plovers was only 16 percent (Lingle, 1988).

Preliminary studies of birds fledged successfully per breeding pair have been conducted in conjunction with MNRR surveys (Schwalbach, 1988; Dirks and Higgins, 1989). These data are presented in table 2.

Table 2
Least Tern and Piping Plover Populations and Nesting Success

	Least Terns		
Year	Adults	Fledged	Fledged/Pair
1986	181	14	0.16
1987	232	80	0.67
1988	252	62	0.49
1989	210	58	0.55
1990	166	32	0.41
1991	193	25	0.35

	Piping Plovers		
Year	Adults	Fledged	Fledged/Pair
1986	172	4	0.05
1987	177	100	1.13
1988	212	66	0.62
1989	122	13	0.21
1990	144	17	0.46
1991	165	29	0.26

The fledgling rates for terns are below those reported recently by Smith (1988) for least terns nesting on the Mississippi River (1.0) and by the USFWS (1990a) for the upper Missouri River between Fort Peck Dam and Lake Sakakawea (1.64). They are slightly better than rates (0.33-0.46) determined for birds on the Platte River in 1988 (Lingle, 1988).

Fledgling rates for piping plover in the MNRR are also considerably lower than those estimated as necessary to maintain the population. In 1988, Prindiville-Gaines and Ryan estimated that an annual fledgling rate from 1.2 to 1.4 chicks/pair was necessary to maintain the piping plover population nesting in North Dakota saline wetland flats.

MORTALITY

Factors significantly disrupting nesting or causing mortality in the MNRR reach include flooding, predators, and human disturbance. These factors can also lead to social disintegration of ternaries. Flooding is a recurrent problem because suitable sandbars have little relief above the water surface. Rises in discharge, resulting from higher releases or tributary floodflows, flood nests and young birds, causing significant mortality. This has been identified as a significant problem in most years (Ducey, 1981; Nebraska Game and Parks Commission, 1985; Schwalbach, 1988). Predation of nests and adult birds is a common problem for shorebirds, including terns and plovers. Surveys and studies in the Great Lakes and the Mississippi and Missouri River drainages have documented mortality occurrences from coyotes, barred owls, great horned owls, ring-billed gulls, and crows (Hardy, 1957; Schulenberg et al., 1980; Dryer and Dryer, 1985; Lingle, 1988; Smith, 1988). Prior to 1987, predation on the MNRR was not reported as significant (Schwalbach, 1988). However, in 1988 and 1989, predation overshadowed other nest mortality factors.

Predators accounted for 28 and 61 percent of all least tern nest losses in 1988 and 1989, respectively, while piping plover nest losses

for the same years were 25 and 83 percent (Dirks and Higgins, 1988 and 1989). Predators observed near colonies include mink, coyote, dog, raccoon, opossum, northern harrier, red-tailed hawk, crow, great blue heron, ring-billed gull, and several snakes. In 1989, direct predation from a dog, mink, and great horned owl was observed (Dirks and Higgins, 1989).

Incidents of predation on nesting terns and plovers tend to increase once vegetation cover and structure develops on a beach, island, or sandbar (Soots and Parnell, 1975). Flooding or other disruptions of colonies may also increase vulnerability to predation (Hardy, 1957; Schulenberg and Schulenberg, 1982). This causes nest and chick abandonment. In the case of terns, the birds which lose nests may move elsewhere or at least are not inclined to engage in "mob behavior" when potential predators encounter a nesting site.

Human recreational disturbance on sandbars has contributed to tern and plover losses in the area. Birds may be repeatedly driven away, nests crushed, or young birds trampled on or scattered. Ducey (1981) reported that 12 of 13 sandbars supporting colonies experienced recreational disturbance. In 1987, 26 of 31 (84 percent) colonies were reported to be disturbed. One colony was abandoned (Schwalbach, 1988). In the 1988-89 period, Dirks and Higgins (1988; 1989) indicated that about one-half of the nesting disturbances were low impact and that extensive visitor education and control techniques significantly reduced losses. It is generally recognized that tern colonies are able to withstand considerable disturbance, unless the disturbance is direct or chronic. Fishing from a boat does not likely disturb nesting colonies, but recreational boating, which creates waves and sandbar erosion, could create direct and indirect adverse effects. Because distance typically provides a buffer zone (Ducey, 1981), direct disturbance to tern and plover colonies from human habitation has not been documented. These

birds are also quite tolerant of human presence as long as there is no overt vandalism (Thompson, 1982).

Efforts to protect tern and plover nesting began in 1987. Informational signs describing the birds and their need for protection were designed by fish and wildlife officials and placed at the Bolten Area boat ramp and at nine colony sites in the area. Despite the posting, six of the nine posted sites received some disturbance (Schwalbach, 1988). Posting and distribution of information on the birds have continued at additional river access areas and islands during 1988-91. Since 1989, bird losses as a result of human disturbance were nearly eliminated.

EFFECTS OF FEDERAL ACTION

Bank Stabilization. Short-term construction work, such as reshaping of unstable banks of the river followed by placement of stabilizing material on the banks, would not by itself directly affect the sandbar habitat of terns and plovers. Although some local scour occurs near the protected bank, the effect does not extend into the sandbar and pool habitat of the main channel.

Long-term small, but not measurable, indirect effects on hydraulic properties and turbidity of the stream would be expected from continuing private bank protection and other bank alteration actions. However, the bank protection actions would have an insignificant effect on the existing channel degradation trend and vegetation encroachment problems.

Boat Access Points. Because the construction of boat access points would probably increase the amount of recreation on the MNRR, competition for sandbars in the river with terns and plovers will continue to increase, especially as the period of demand overlaps considerably. This competition is further intensified by the declining

amount of the resource. Least terns will lose out in this competition, as they have already in parts of the MNRR.

The management plan for the MNRR originally envisioned development at 13 sites along the MNRR below Yankton. To date, public facilities are provided at only four of these sites. Although channel instability and other adverse hydraulic parameters have discouraged some public uses, overall recreational use has greatly increased over the years. This is especially the case near Yankton, where public facilities have been overloaded during periods of peak use.

The completion of the new facilities at Yankton's Riverside Park has satisfied considerable demand in the upstream reach of the MNRR. However, the most recent Nebraska State Comprehensive Outdoor Recreation Plan (SCORP), as well as the South Dakota SCORP, indicates there are shortages of river access areas and related facilities in the planning area served by the MNRR. A new boat access area near Mulberry Bend in Dixon County is currently proposed to meet part of this demand in the downstream third of the MNRR. The boat access is planned to have minimal facilities (ramp, parking area, and vault toilet); however, heavy use of the ramp is not expected.

However, many private landowners along the river have expressed an interest in developing their own private boat ramps. If permitted, these ramps would increase visual impacts along the shoreline, as well as adding to the existing river use. This work could induce some additional development of residential areas that could create additional competition between river users and shorebirds for limited sandbar space.

In conclusion, impacts related to the recreation activities along the MNRR have the potential to significantly impact nesting success of the birds. Because of the limited population base near the proposed

Dixon County ramp, few adverse impacts to the least tern and piping plover are expected. Historical nesting sites for the least tern and piping plover are located from 1.5 to 3 miles from the proposed ramp. As a condition of the permit for this particular ramp, the managing agency would be required to post and cordon off any areas within a 3-mile radius where nesting terns and plovers are found. However, the added visitation as a result of private boat ramp development would increase competition between birds and recreationists for available sandbar space during the mid-June to August period and thus would have an adverse impact on least tern and piping plover breeding and nesting on area sandbars.

Boat Docks/Fishing Piers. It has been determined that the construction of private boat docks or fishing piers would not have any impact on terns and plovers using sandbars in the MNRR unless there would be some additional development onshore that would result in an increase in visitation. Any extensive shoreline development associated with a newly constructed boat dock would be discouraged. Recreationists would be able to dock their boats at the nearby residences instead of beaching them along the shoreline and potentially degrading the visual esthetics of the area. Recreationists would not have to cruise the river several times each day to dock the boats at existing facilities. Shoreline or pier fishing would not have any impact on terns or plovers nesting on sandbar islands.

Irrigation and Domestic Intakes. Intakes are located close to the shoreline and do not appreciably change the volume of water in the river. Therefore, irrigation intakes would not be expected to impact the nesting habitat of the terns and plovers.

ESKIMO CURLEW

POPULATION LEVELS

The Eskimo curlew (*Numenius borealis*) is a medium-sized shorebird approximately 30 cm long with a 5-cm-long slender, slightly down-curved

bill. This species has uniformly dark primaries, greenish legs, chevron-like markings on the breast, and a pinkish base to the lower mandible. The color of the lower mandible and the presence of V-shaped breast markings are critical characteristics in separating the Eskimo curlew from the closely related little curlew (*Numenius minutus*).

The Eskimo curlew is among the rarest bird species in North America. This species was placed on the United States endangered species list in 1967 and was declared endangered in Canada in 1980. Reports from as late as the 1860's and 1870's indicated that the Eskimo curlew occurred in tremendous numbers. By the late 1880's, however, the species had noticeably declined throughout its range, and many ornithologists considered the Eskimo curlew extinct or nearly so by the early 20th century (Faanes & Senner, 1991).

Since 1959, 15 sightings of Eskimo curlews have been reported on 11 separate occasions during the fall migration in North America and the West Indies; however, only 1 sighting was confirmed by a photograph or specimen. In April 1987, Faanes observed an adult Eskimo curlew foraging in the mowed prairie grasses approximately 27 miles south of Grand Island, Nebraska (Faanes, 1990). Prior to that sighting, the last confirmed record in Nebraska was a group of eight birds observed 10 miles east of Hastings, Nebraska, in April 1926. The frequency of both confirmed and unconfirmed sightings of Eskimo curlew in the United States and Arctic Canada prompted the U.S. Fish and Wildlife Service and the Canadian Wildlife Service to begin an Eskimo curlew recovery effort in January 1990.

Historically, Eskimo curlews followed a relatively narrow migration corridor in the spring. This corridor ran from the Texas coast north through the plains States in the Missouri/Mississippi river drainages to the prairie provinces in Canada and then northwest to the Arctic. Most spring migration sightings in the United States are from late March through the end of April. Sightings in Canada are usually during mid-May.

In the fall, the curlews left the Arctic nesting grounds in Canada (and possibly Alaska) and migrated east and south to the north Atlantic coast. Between mid-August and late September, large numbers of birds were reported spending several weeks on the coast, especially in Labrador, where they fattened up and then departed in what was probably a nonstop flight to Argentina or elsewhere in South America (Faanes & Senner, 1991).

BREEDING CHRONOLOGY

Historic breeding grounds of the Eskimo curlew were along the Arctic coast between the Anderson and Coppermine Rivers and south to Great Bear Lake (USFWS, 1980). Considerable debate exists regarding the current status of the Eskimo curlew and its nesting grounds. In 1987, there were reports of curlews nesting on the traditional breeding grounds in northwest Arctic Canada (Faanes & Senner, 1991). However, the Canadian Wildlife Service stated that there were no confirmed nest records from Arctic Canada at that time.

Nests are shallow depressions in the open tundra and are sparsely lined with leaves and dried grasses. There are usually four eggs to a clutch. The eggs are dark brownish green to blue blotched and resemble the color of grass. Eggs are usually laid between late May to mid-June. The time of hatching and the length of time young are dependent on the adults is unknown. However, by the end of July, the breeding season is usually over and the adults begin heading south, followed soon after by the young.

HABITAT

The Eskimo curlew nested on treeless Arctic tundra. Its feeding grounds were primarily open, natural grassland and tundra; burned prairies; meadows; pastures; and plowed lands. Intertidal zones were used during migration and wintering.

During the spring migration, grasshoppers and their egg capsules, or pods, were important foods (USFWS, 1980). The egg pods were obtained

by probing in unplowed prairie land. Ants were eaten on the tundra breeding areas. The chief food in late summer on the Arctic tundra and the migration staging area in Labrador was crowberry and blueberry. A small species of snail abounding on rocks in intertidal areas in southern Labrador was also eaten extensively.

MORTALITY

Market hunting and sport shooting figured prominently in the population reduction of the Eskimo curlew. An increase in the number of storms in the North Atlantic during fall migration and lower ambient temperatures on the breeding grounds in Arctic Canada in the 1880's may have also caused increased mortality and reduced reproductive success. The decline may also have been related to habitat loss, both on the wintering grounds of the Argentine Pampas and at migration stops on the North American prairies.

Historically, in the spring, Eskimo curlews were found on pieces of land that had not been plowed and where the grasshopper eggs were laid. It has been suggested that because grasshoppers avoid laying eggs on cultivated land, a decline in the availability of egg pods may have prevented the curlew's recovery (Faanes & Senner, 1991). Declines in the huge flights of grasshoppers on the Great Plains occurred concurrently with the loss and fragmentation of Great Plains grasslands. These losses were due to cultivation, a reduction in the extent and frequency of fire, and the demise of great herds of American bison.

Although the specific reasons for the decline in population of the Eskimo curlew are unclear, it is evident that the population of the curlew has never recovered. This is in spite of the fact that the Eskimo curlew has been protected from hunting in the United States and Canada since the passage of the Migratory Bird Treaty Act in 1918.

EFFECTS OF FEDERAL ACTION

The Eskimo curlew is expected to occur in the area only as a rare migrant. The species prefers habitat that consists of open meadows. The MNRR project lands are mostly croplands, woodlands, and recently accreted river bottomlands. Therefore, it is not expected that the minor Federal actions will affect the Eskimo curlew.

PALLID STURGEON

POPULATION LEVELS

Pallid sturgeon (*Scaphirhynchus albus*) and shovelnose sturgeon (*Scaphirhynchus platorynchus*) are closely related fishes, as determined by electrophoretic and morphological studies. The pallid sturgeon is believed to have been an occasional resident along the middle and upper Missouri River, prior to impoundment of the river by dams. Over 500 sturgeon were captured by fishermen after being trapped in Lake Francis Case, Lake Sharpe, and Lake Oahe (Keenlyne, 1989).

Pallid sturgeon numbers have dwindled because of the construction of dams on the river. This has affected reproduction, feeding, and other activities (Keenlyne, 1989). Currently, pallid sturgeon are known or possibly exist in parts of the Missouri main stem and near the confluences of major tributaries such as the Yellowstone, Platte, and Kansas Rivers. The shovelnose sturgeon, however, has been able to maintain numbers in the unchannelized and free-flowing parts of the river (Schmulbach et al., 1975; Kallemeyn and Novotny, 1977) with population estimates as high as 3,000 per kilometer (km) (Schuckman, 1982).

Small numbers of pallids have been recently documented in the river above Fort Peck Lake, from Fort Peck Dam to the Garrison reservoir, in the headwaters of Lake Oahe, below Oahe Dam in the upper end of Lake Sharpe, and in the river below Gavins Point Dam to the mouth of the

Kansas River. Only three pallids have been caught in the MNRR in the past 20 years (Gilbraith et al., 1988) and only twelve fish have been captured within the entire Missouri River during the past 1 to 2 years.

All States along the Missouri River consider the pallid sturgeon as endangered or threatened, except the State of Montana, which identifies it as a species of concern. All of these States have a "must release" regulation, except in Montana where pallids under 16 pounds can be taken legally. Recently, the State of North Dakota has prohibited the taking of all sturgeon, even the shovelnose, as this species is not easy to differentiate from young pallids (Harberg, 1990). Sturgeon culture is conducted at some Federal hatcheries in the United States. The USFWS operates a Federal hatchery at Gavins Point Dam and is conducting some limited studies on sturgeon propagation. It is generally agreed that artificial propagation of pallids is needed if there is any hope of conserving the pallid sturgeon.

BREEDING CHRONOLOGY

These conditions are poorly understood but are assumed to be quite similar to those of the shovelnose sturgeon. The habitats of the two species overlap and natural hybridization occasionally occurs. (Carlson et al., 1985). Pallid sturgeon are slow growing and mature at an unknown but probably advanced age. One specimen was aged at 27 years (June, 1981) and three others at 10, 37, and 41 years (Gideon, 1990). Males are known to spawn at 3 to 4 years (Fogle, 1961) and females perhaps at 5 to 6 years. Based on what is known about other sturgeons, spawning occurs between June 1 to August 1 but is likely at a low frequency of once every few years (Gilbraith et al., 1988). Preferred sites would likely be near the mouth of river tributaries over gravel or rock substrates in areas subjected to moderate water velocities. Triggering variables for spawning may include flow rises, day length, or water temperature. Again, based on observations of other sturgeons, eggs would be expected to take from 5 to 8 days to hatch and would be

subject to burial by moving bed loads and other problems at these times. Despite numerous surveys, the occurrence of pallid spawning has never been confirmed in the MNRR.

RIVERINE HABITAT

Shovelnose and pallid sturgeons prefer large, turbid river systems. Impoundment of these systems cause reductions in sturgeon numbers. Along the Missouri main stem reservoirs, North Central Reservoir Investigations documented that catches declined drastically each year after impoundment (Shields, 1958; Sprague, 1959). These studies ceased in 1975 and now a data gap exists on pallid sturgeon life history. For this reason, information on shovelnose sturgeon is added in order to assemble a tentative habitat profile for pallids.

Studies have shown that shovelnose sturgeon are abundant in riverine pool areas that are from 1.8 to 4.6-m deep and with slow currents and behind sandbars in fall, winter, and spring seasons (Schmulbach et al., 1975; Moos, 1978; Kallemeyn and Novotny, 1977). During the summer, shovelnose sturgeon were quite evenly distributed among different riverine habitats, possibly related to the availability of food, reproductive activities, or cooler waters released in large quantities from Gavins Point Dam (Moos, 1978). In general, habitats utilized by pallids appear to be similar to those of the shovelnose (Kallemeyn and Novotny, 1977).

Pallid and shovelnose sturgeons are considered to be opportunistic feeders, consuming aquatic insects, crustaceans, mollusks, and annelids. Trautman (1957) reported congregations of shovelnose sturgeons in riverbeds containing large quantities of small clams and snails. In some cases, fish and fish eggs have been found in the diet of pallid sturgeons including small forage fishes and sauger. The location of the mouth on the ventral surface, the presence of protrusile lips for sucking, and the presence of sensory barbels and small eyes suggest

primarily a feeding habit of raking the bottoms of turbid waters. When the barbels encounter a food item, the material is ingested along with any loose substrate. Food studies of the shovelnose in the Missouri River indicated a predominance of chironomids, mayfly larvae, and cadisfly larvae (Held, 1969; Gardner and Stewart, 1987). In the MNRR, the lower body condition of shovelnose may be related to inadequate food supply related to degraded habitat conditions (Whitley and Campbell, 1974; Hesse, 1987). It has been noted that pallid sturgeon are smaller in the lower river (Gavins Point Dam to the Kansas River) than those in the upper Missouri River (Garrison Dam to Fort Peck Dam), where more natural river habitat conditions are found (Harberg, 1990).

MORTALITY

These factors are poorly understood. Studies on shovelnose sturgeon in the MNRR have indicated that they are relatively parasite and disease free (Keenlyne, 1989). The same would probably be true for pallids. Mature pallids are not known to be taken by any predator except man. The fate of young pallids, however, is not known. A general increase of piscivorous fishes has characterized the Missouri River and its impoundments in the past 30 years. Large predators include white bass, walleye, and various salmonids. White bass and skipjack herring, both of which occur in the MNRR, are sight feeders and were not reported in the Missouri River until recently (Funk and Robinson, 1974). Eggs of lake sturgeon are vulnerable to suckers, carp, catfish, and even other sturgeon species (Becker, 1983), and it is very possible that the eggs of pallids are also consumed by other fish. In some aquatic systems, exotic predator fish have been known to decimate populations of native fishes utilizing smaller prey.

There may be interspecific competition between pallid and shovelnose sturgeon, especially because the river habitat has been hybridized and simplified, reducing suitable habitats for spawning and feeding. Indeed, competition for spawning may be indicated by the

occurrence of hybridization between the two species (Pflieger and Grace, 1986). Commercial fishing operations, which take a wide variety of river fish, could also result in the loss of some pallid sturgeon if captured fish were mistaken for shovelnose and not released. In addition, sturgeons are easily entangled in drift nets.

EFFECTS OF FEDERAL ACTION

The pallid sturgeon would not likely be affected by further bank stabilization or by additional recreation. This is because of its rare occurrence (three captures in the past 20 years) in the MNRR; apparent sub-optimal habitat conditions in the reach (low turbidity, decline of nursery areas; and altered flow and temperature regimes), and low potential of projects to affect any spawning, feeding, or resting areas. Sport fishing of the species has been eliminated so additional sport fishing should have no impact.

Short-term bank stabilization work would not by itself directly affect the aquatic habitat of the pallid sturgeon. Although some local scour occurs near the protected bank, the effect does not extend into the sandbar and pool habitat of the main channel. In addition, the work is normally accomplished at times and places where pallid sturgeon spawning, feeding, and resting would not be likely. Important habitats for this fish are submerged gravels for spawning and deep river pools and quiet backwaters for other life stages. The bank work would be concentrated along the channel edge which would only receive minimal or transient use by any pallid sturgeon in the reach. A resident population, if one exists, would not be affected on a long-term basis.

AMERICAN BURYING BEETLE

POPULATION LEVELS

The American burying beetle (*Nicrophorus americanus*) is the largest member of its genus in North America. This species ranges from 25 to 35

milimeters (mm) in size and is sometimes referred to as the giant carrion beetle. In addition to its large size, the American burying beetle is identifiable by a large orange-red pronotal disk. This disk, the orange antennal club, red frons, and two pairs of scalloped red spots on the elytra (wing covers) contrast sharply with a black background.

Although once widely distributed throughout eastern North America, the American burying beetle has disappeared from most of its historic range. This range included 32 States, the District of Columbia, and 3 provinces in Canada. The range encompassed an area from Nova Scotia and Quebec, south to Florida, and west to Minnesota, South Dakota, Nebraska, Oklahoma, and Texas (Schweitzer and Master, 1987). There are two extant populations known consisting of a total of fewer than 1,000 individuals. One of these populations is located on Block Island off the coast of Rhode Island and the other is located in eastern Oklahoma. In addition, there are two laboratory colonies being maintained for research and propagation purposes. Unless it occurs in very localized areas, it appears unlikely that the species still exists on the mainland of the Northeast.

Until July 1988, the latest collection of the beetle in Nebraska was in 1972. In 1988, the most recent specimen was collected at North Platte about 1 mile from the Platte River. In 1989, Jameson and Ratcliffe conducted an intensive survey around the State in search of the insect but found no evidence of the species. The latest collection of the beetle in South Dakota is from 1946 (Kirk). The collection sites have been recorded in Brookings, Brookings County; Elk Point, Union County; and Nowlin, Haakon County.

BREEDING CHRONOLOGY

According to Schweitzer and Master (1987), the biology of *N. Americanus* is similar to other species of the genus, except that the

carrion selected tends to be somewhat larger. Beetles are attracted to the carrion at night. Males and females fight among themselves until only one pair (usually the largest male and female) remains on the carcass. Burial usually takes place before dawn of the first morning. A chamber, approximately 20 cm deep in the soil, is constructed around the carrion which may have been moved underground over a meter from its original burial site. The chamber depth prevents other scavengers, particularly flies, from finding the carcass. As the corpse decomposes, it is fed upon by the adults and worked into a compact ball, with a conical depression which collects the liquids. Eggs are laid on the carrion or on the walls of a passage directly above the carcass, and the hatched larvae are fed on the liquids. At least one but usually both parents remain with the eggs and larvae. The beetles emerge in 48 to 56 days. Brood size varies between 8 and 23 teneral adults eclosed. Parents and young separate shortly thereafter. The young, which emerge in July and August, do not reproduce until the following June or July. Adults appear to overwinter singly in the soil.

Vertebrate carrion that weighs between 50 and 200 grams is acceptable to the beetles. These include species such as fish, various birds, rats, squirrels, and chipmunks. Schweitzer and Master reports no preference between bird and mammal carrion. With mammals, the hair is partially removed and pushed aside and bones are eaten.

HABITAT

Anderson (1982) postulated that the natural habitat of the species is mature climax forest. Habitat occupied by the known population includes maritime shrub thickets and coastal moraine grassland. Recent captures (post 1960) in the Midwest were mixed from agricultural lands, including pastures and mowed fields, and ordinary second growth woods. Most investigators agree that significant humus and top soil for the burying of carrion is an essential requirement of the American burying beetle (Schweitzer and Master, 1987).

MORTALITY

The reason for the marked decline in *N. americanus* is unclear. Anderson (1982) hypothesized that the reduction in the population of the beetle was due to the destruction of virgin (primary) forest habitat. However, this belief was disproved by the many records documenting collections of the species in locations more than 100 years after destruction of primary forests. In addition, the site of the known population in New England supports no forests and, in fact, has not been forested for at least 200 years. Although it is possible that the loss of some habitat component has contributed to the reduction of the species, habitat generally similar to that of the known population is not uncommon (Schweitzer and Master, 1987).

Another explanation for the decline in the American burying beetle population is the contamination of its food supply with DDT (Schweitzer and Master, 1987). Block Island, unlike most of the other New England islands and much of the mainland, has never been extensively sprayed to control mosquitoes or gypsy moths. Saturniid and Sphinx moths congregated on Block Island between the mid-1960's and early 1980's. During this same time period, numbers of these moths were very low on the mainland. Apparently this was due to earlier suppression efforts for the gypsy moth. However, there are large areas where the populations of burying beetle have declined or disappeared where the population of moths did not decline and where there was not widespread spraying of DDT.

Light pollution from the proliferation of mercury-vapor streetlights is another possible reason for the decline in *N. americanus* numbers. This idea was suggested by Ferguson in 1971 and again by Hessel in 1976 (Schweitzer and Master, 1987). This was an alternative explanation for the decline of the larger moths in the Northeast. Although this could explain the decline in beetle numbers in highly-

developed areas, Schweitzer and Master (1987) do not consider it to be a credible explanation for the decline of *N. americanus* in rural areas.

Predation has probably not been a factor in this species' decline, but introduction of a nonnative, species-specific pathogen could explain the fact that this species has disappeared while several other species of the same genus with similar habits continue to thrive (USFWS, 1989a).

Schweitzer and Master (1987) conclude that the cause of the decline of the *N. americanus* is unknown. The biggest fault with most of the above explanations is that they should apply to all *Nicrophorus* species, yet only one (*N. americanus*) has declined severely. A recovery plan for the American burying beetle was prepared by the USFWS in 1991. This recovery plan stresses the stabilization of the two extant populations and the establishment of at least 14 additional populations throughout its former geographic range.

EFFECTS OF FEDERAL ACTION

There is a small possibility that this species could be found in the project area. The historic range of the species includes the project area. Some experts believe that the species has essentially disappeared from most of its former range and that only very localized populations may remain. Recent attempts to capture the species have failed. With this information, it seems unlikely that the species may be found in the MNRR project area even with an aggressive campaign to locate individuals. Therefore, it is not expected that the species would be impacted by the minor Federal action listed.

WESTERN PRAIRIE FRINGED ORCHID

TAXONOMY AND POPULATION LEVELS

The western prairie fringed orchid (*Platanthera praeclara*) is restricted to the areas west of the Mississippi River. This species,

along with the eastern prairie fringed orchid, was listed as threatened in 1989.

The western prairie fringed orchid is an herbaceous, perennial orchid with fleshy roots arising from a tuber. The plant usually reaches a height of 3 to 4 feet with rounded to lance-shaped leaves. Leaves and an inflorescence usually emerge in May and flowering begins by late June to early July. The flower features a long tubular spur which projects back toward the stem and prominent, fringed, three-lobed lower petal. The flowers are fragrant after sunset and adapted to pollination by night-flying hawkmoths. The fruit is a 1-inch long elongated capsule and remains attached to the stem. The small, abundant seeds are released through slits that develop in the fruit. The seeds are windblown but also may be adapted for water dispersal.

GEOGRAPHICAL DISTRIBUTION

The orchid originally was widespread from the Mississippi River west to eastern Kansas, central Nebraska, and extreme eastern North and South Dakota. Historical populations were also located in Brookings and Minnehaha Counties in South Dakota (Bowles and Duxbury, 1986).

Habitat typically consists of moist, calcareous or subsaline tallgrass prairies and sand sedge meadows with full sunlight. Within these habitats, orchid populations usually occur in sinuous swales and sedge-dominated lowlands that originate from ground water seeps at the edge of ancient beach ridges. The orchid can best be located when it blossoms in late July; however, it will often not blossom if drought conditions exist or if heavy grazing occurs.

In 1989, Freeman and Brooks conducted ground surveys for the western prairie fringed orchid in areas in Nebraska and South Dakota where this species was most likely to occur. In Nebraska, these selected areas included the native meadows along the Platte River flood

plain and the native, subirrigated meadows in the sandhills region. Extant populations of the orchid were located or were believed to exist in Cherry, Hall, Lancaster, and Seward Counties in Nebraska. In addition, historic collections are known to have been made in Pierce and Antelope Counties. However, most areas that were surveyed were slightly to severely drought stressed and may have affected the ability to locate this species.

Ground surveys for the orchid were also conducted at selected sites in South Dakota (including Clay and Yankton Counties). However, because of extreme drought conditions in the Great Plains in 1988 and 1989, many areas of potential habitat were moderately to severely drought stressed and no orchids were found in the State.

REASONS FOR DECLINE

The orchid currently occurs in 37 known populations in seven states (Bowles and Duxbury, 1986). Western prairie fringed orchid has declined significantly throughout its historical range primarily because of habitat loss and degradation. Conversion of prairies for row crops, fire suppression, haying, gravel mining, and land development are factors which have contributed to the species' decline (USFWS, 1989b). Agricultural practices, such as grazing and herbicide and pesticide use, may have also impacted the species. The orchid's populations have been jeopardized by heavy litter buildup in the soils. The suppression of low-intensity prairie fires, formerly common the region, has eliminated potential orchid habitat. Successional changes resulting in woody plant development is yet another threat to the survival of the species.

EFFECTS OF FEDERAL ACTION

The MNRR project lands are mostly croplands, woodlands, and recently accreted river bottomlands. The project contains no prairie habitat suitable for the prairie fringed orchid. Therefore, the minor Federal actions are not expected to affect the species.

CONCLUSIONS

The minor Federal actions that have been assessed in this document include the following: (1) bank stabilization of less than or equal to 500 feet of eroding banks; (2) boat ramp construction; (3) boat dock and fishing pier construction; and (4) irrigation and domestic intake placement. Based on the above discussions, it has been concluded that the identified Federal actions are not likely to adversely affect the Eskimo curlew, pallid sturgeon, American burying beetle, and western prairie fringed orchid. The least tern and piping plover would not likely be affected by any of the Federal actions with the exception of the construction of private boat access points.

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